

Response to the CD-1 Review Recommendations of August 7-9, 2006

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Neutron Electric Dipole Moment (nEDM) Project

1. **Recommendation:** “Generate an aggressive risk-based R&D plan for the remainder of the project that specifies priorities and deliverables and deliver to agencies by November 1, 2006.”

Response: A risk based R&D Plan was generated and submitted to DOE on November 1, 2006. The document is available on the mini-review web site.

2. **Recommendation:** “The CPM should organize special task forces involving appropriate experts across the collaboration focused on the highest risk subsystems. Examples include the cryogenic valve issue, the HV system, and SQUIDs operating in the HV environment.”

Response: The CPM appointed an advisory committee consisting of Jan Boissevain (Consultant) – Chief Engineer, Bob Golub (NCSU), Geoff Greene (Tennessee/ORNL), Mike Hayden (SFU), Steve Lamoreaux (Yale) – Co-spokesperson. The entire R&D program was reviewed at the October nEDM Collaboration meeting, and the following CPM actions have either resulted or are in progress:

- Promote duplicate effort on ^3He relaxation
- Get other institutions to assist in valve development
- Search for addition funding for full valve test
- Encourage NCSU team not to distract the Duke team
- Get agreement on magnet uniformity requirement
- Search for addition funding for the ^3He holding coil
- Increase scientific staffing on the HV tests
- Redirect engineering and technician efforts to the new cryostat
- Get Yale to coordinate the SQUID effort
- Get other institutions to assist in the ^3He injection test
- Decide whether to fund the laser fluorescence work
- Withhold funding of the slow controls prototype
- Request a set of standards for slow controls

3. **Recommendation:** “Valve development should be treated as a high priority for the project, and its progress should be reported at the project quarterly reports to DOE.”

Response: Valve development has always been treated as a high priority. The bucket dewar test of seating materials is underway at the University of Illinois. Progress reports will be part of nEDM’s quarterly reports.

4. **Recommendation:** “Prior to CD-2, perform an analysis of the impact that pressurization of the measuring cell will have on other subsystems.”

Response: Pressurization has been part of the nEDM planning for roughly one year. As the results of the high voltage R&D become available, the role of pressurization will become clear. An analysis of pressurization will be available prior to CD-2.

5. **Recommendation:** “Explore the involvement of other institutional collaborators in this (1.6) work breakdown structure (WBS) element to take on some of the responsibilities.”

Response: In the judgment of the CPM, the priority for augmenting the workforce with available staff is in the valve and ^3He -injection work packages. The CPM has worked to

this end. Thus, no new institutions have been added to WBS 1.6. The workforce remains LANL Group P-25 (Subatomic Physics; work package manager with many responsibilities), LANL Group P-21 (Applications of Modern Physics; SQUID work), UC Berkeley (Kerr effect measurement of the electric field), Indiana (high voltage and SQUIDs), and Yale (SQUIDs and innovative techniques). Negotiations are currently underway with a potentially new collaborating institution that could augment the staff available to WBS 1.6. Meanwhile, LANL Group P-25 is recruiting two new staff, one entry level and one experienced, and two new postdoctoral fellows to increase its workforce.

6. **Recommendation:** “Prior to CD-1, the project team should revisit the assembly and commissioning plans, including more robust and transparent cost comparisons, in the context of FNPB plans to acquire cryogenics expertise and after the logistics of the alternative plans have been further vetted, both by the project and TUNL administration.”
Response: The CPM asked the committee composed of Paul Huffman (NCSU), Vince Cianciolo (ORNL) and Geoff Greene (UT/ORNL) to review the assembly and commissioning plan. Under the condition that ORNL would provide a cryogenic physicist in a timely way, the mainstream plan has moved to assembly at the FNPB. The TUNL option has been dropped. Negotiations are currently underway among DOE NP, ORNL and nEDM to search for ways and means to employ the cryogenic physicist. The cost comparisons and schedule implications for FNPB assembly will be explained at the December mini-review.
7. **Recommendation:** “Prior to CD-1, revisit bottoms-up contingency assessment with a more rigorous use of the risk-based contingency estimating methodology.”
Response: A new bottoms-up contingency assessment has been performed based on the risk-based contingency methodology employed by the FNPB. A workshop for the subsystem managers was held to jointly evaluate real examples with the purpose of obtaining rigor and consistency. The result has been to raise the contingency from 22% to 33%. The results will be related at the December mini-review.
8. **Recommendation:** “In light of reported cost increases relative to CD-0, repeat a bottoms-up cost analysis that identifies efforts taken to contain costs, prior to CD-1. Generate a profile of the upper TPC range, broken out into OPC and TEC, with planned CD dates.”

Response: A new bottoms-up roll up of the cost analysis has been completed. The results will be presented at the December mini-review. The required information should be transparent. Most of the information is available in the latest draft of the Preliminary Project Execution Plan (PPEP).

9. **Recommendation:** “Should the TUNL option be exercised, a plan for implementing safety plans at TUNL should be generated prior to CD-2.”
Response: The nEDM Collaboration has no intention of exercising the TUNL option unless ORNL cannot provide cryogenic expertise. If the unlikely event that the TUNL option were to be revived, the safety issues would be worked out with TUNL.
10. **Recommendation:** “Prior to CD-1, update the risk assessment plan to incorporate comments made at this review.”
Response: The nEDM Subsystem Managers participated in a workshop to evaluate the risk of realistic examples in order to gain consistency in the evaluation of risk throughout the project. The subsystem manager applied this experience to generate a new risk plan

and risk log that are available on the mini-review web site. The likelihood table was brought into conformity with those used in other Office of Nuclear Physics projects and the impact table was modified to match the specifications of the nEDM project.

11. **Recommendation:** “Prior to CD-2, develop testing plans that identify the activities and goals for the performance tests of the subsystems at the individual institutions and the assembly site.”

Response: The nEDM Project will develop testing plans and performance specifications for the individual subsystems prior to CD-2. The preparation of this report will be of great utility.

12. **Recommendation:** “In preparation for the CD-1, the management should take all possible steps to decrease cost, mitigate risk, and increase schedule float, including such traditional approaches as, descoping exercises, attracting international collaborators, eliminating sequential, redundant activities, as well as developing a more aggressive risk-based R&D plan. The project office should report to the agencies on the project status prior to February 1, 2007 and CD-1 approval.”

Response: The response to this recommendation is the main subject material for the presentations at the December mini-review. Most of the issues have been addressed in the PPEP. So far, there has been no yield from our attempts to attract more international collaborators. The project office has been discussing the evolution of the project with the agencies continuously since the August review. The December mini-review should respond to most of the requests contained in this recommendation.